Space Weather Technical Forecast

Issued on Thursday, 13 June 2024 at 12:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-flares (R1-R2 radio blackouts). Slight chance of Minor solar radiation storm (S1) initially, this risk declining into the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate, with an isolated M1.2 at 12/2246 UTC attributed to AR3711 near the south-centre disc. There are currently 10 sunspot regions on the visible disc. AR3709 is now considered to be a mature region, consisting of a single leader followed by smaller trailing spots and has shown little or no development in recent hours. The largest region is now AR3712 in the southeast, which includes a proliferation of minor trailing spots and an increasing magnetic complexity. The other regions are relatively small and simple.

A filament eruption was observed around 12/1200 UTC in the southeast. The associated CME may have an Earth-directed component however there is currently no available imagery to do the analysis. A faint CME associated with an M1 flare at 22:46 UTC from AR3711 may have an earth directed component, however due to imagery drop-outs and its very faint outline this is very difficult to analyse. It may however give some contact with earth early on Day 3 (15 Jun), but this is very low confidence.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, were indicative of a slow regime. The speed was stable and slow-ambient, around 350km/s through the period, with largely below average density. The IMF (Interplanetary Magnetic Field), Bt, was weak and unremarkable throughout, with only slight deviations (-4/+5nT) of the north-south component, Bz. The phi angle was predominantly positive (away from the Sun), with only brief negative intervals (towards the Sun). Geomagnetic activity was Quiet (Kp 0-1) as a result.

Energetic Particles / Solar Radiation: The high-energy (greater than 10 MeV) proton flux observed by GOES18 has been near, but just below, the S1 threshold, showing a slight decreasing trend over the past few hours.

High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels, with the associated 24-hour fluence well below Active. Observed fluence at 13/0000 UTC was 1.24e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of isolated M-class flares, with just a slight chance of X-flares initially, most probably from the declining AR3697 in the short term. The flare risk reduces into the period pending further developments.

Solar Wind / Geomagnetic Activity: Overall geomagnetic activity is expected to remain predominantly Quiet with a chance of Unsettled intervals. However there is a slight chance of Active/G1 (Kp4-Kp5) intervals from Day 3 (15 Jun) should we see any impacts from possible CMEs or coronal hole influences.

Energetic Particles / Solar Radiation: High energy proton flux is currently close to S1/Minor solar radiation storm levels after a recent far-sided CME. It is expected to ease over the coming days but a chance for further enhancement remains, with the slight chance of S1 maintained for

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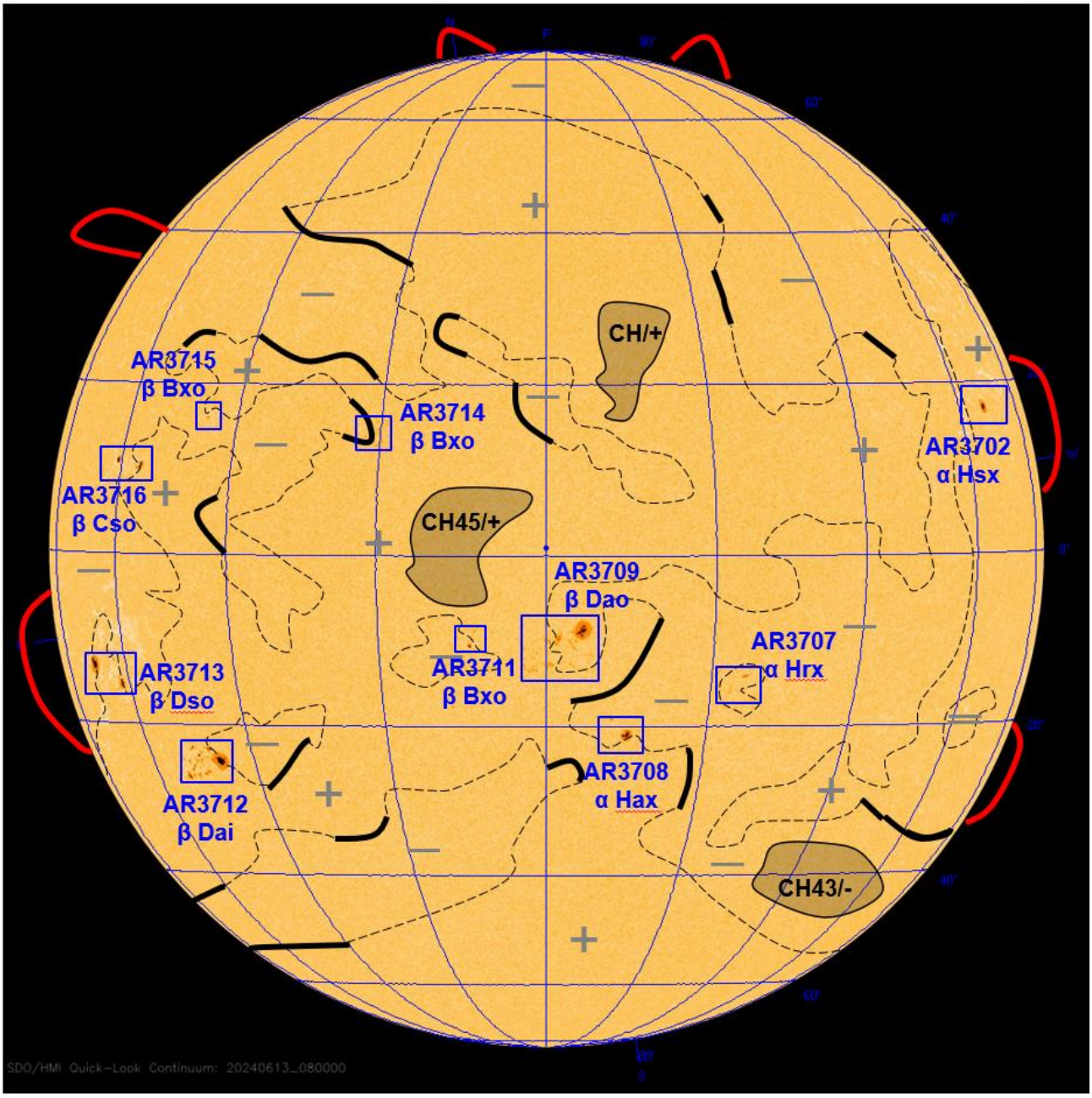
Day 1 and Day 2 (13-14 Jun), but becoming less likely with time.

High energy electron flux is forecast to persist at predominantly background levels, and the associated 24-hour fluence is expected to remain below the Active threshold.

Figure 1. Solar Analysis Valid 13/0800 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A filament eruption was observed around 12/1200 UTC in the southeast. The associated CME is expected to be too far south to affect Earth. A faint CME associated with an M1 flare at 22:46 UTC from AR3711 may have an earth directed component, however due to imagery drop-outs and its very faint outline it has not yet analysed. Using non-ENLIL methods and an assumed speed of around 1000 km/s this CME may give some contact with earth early on Day 3 (15 Jun), but this is very low confidence and further imagery will be required to conduct proper analysis.

Solar wind speeds are now at background levels following recent CME influence and are expected to remain so through much of the period. A coronal hole (CH43/-), considered to be in a geo-effective location in the southwest, may connect with Earth in the next few hours. However it looks small and far from the centre disc, with limited geomagnetic response expected. Another small coronal hole has recently appeared near the north-centre disc. Its high speed stream may connect with Earth on Day 4 (16 June) but it's difficult to estimate the level of geomagnetic response given it was absent on the last rotation. Judging from its size though, it should not be able to bring much more than slightly elevated solar wind speeds and a few Unsettled geomagnetic intervals.

Overall geomagnetic activity is expected to remain predominantly Quiet with a chance of Unsettled intervals. However there is a slight chance of Active/G1 (Kp4-Kp5) intervals from Day 3 (15 Jun) should we see any impacts from possible CMEs or coronal hole influences.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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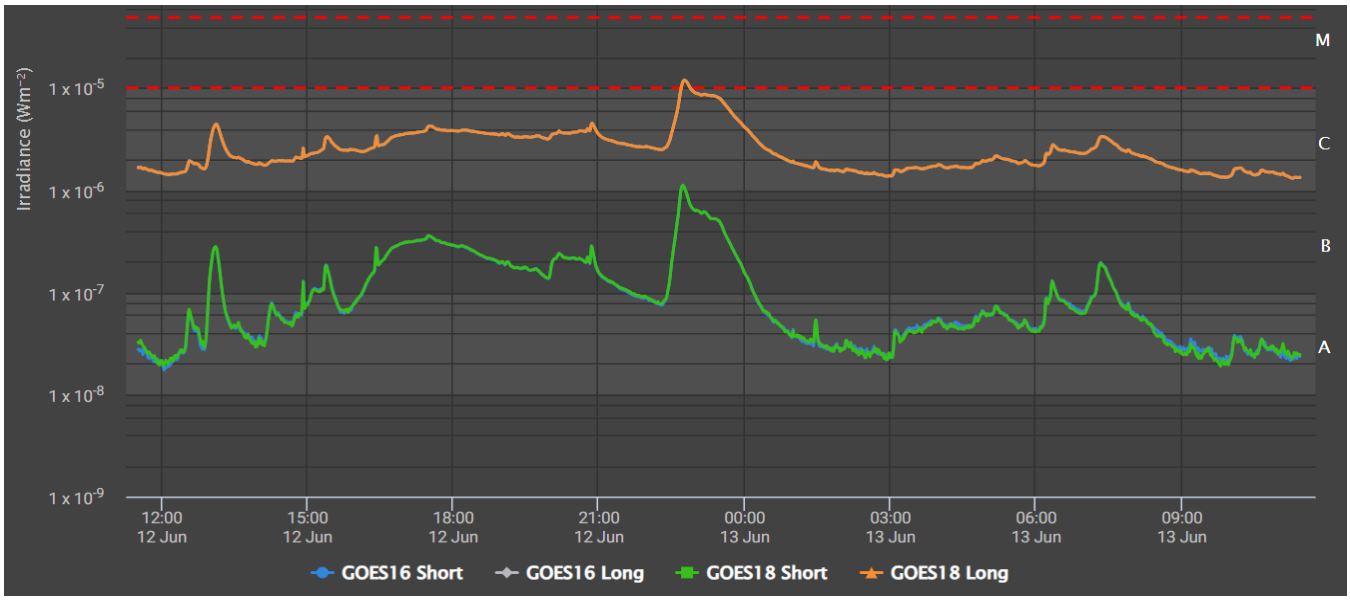
Radio Blackouts - X-Ray Flares:

There are currently 10 sunspot regions on the visible disc. AR3709 is now considered to be a mature region, consisting of a single leader followed by smaller trailing spots and has shown little or no development in recent hours. The largest region is now AR3712 in the southeast, which includes a proliferation of minor trailing spots and an increasing magnetic complexity. The other regions are relatively small and simple.

There is a chance of isolated M-class flares, with just a slight chance of X-flares initially, most probably from the declining AR3697 on the far side in the short term. The flare risk reduces into the period pending further developments.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	30	30	30	30
Very Active	R3 to R5 X Class	No	5	1	1	1

Figure 2: Latest GOES-18 X-Ray Flare Activity showing the M1.2 at 12/2246 UTC.



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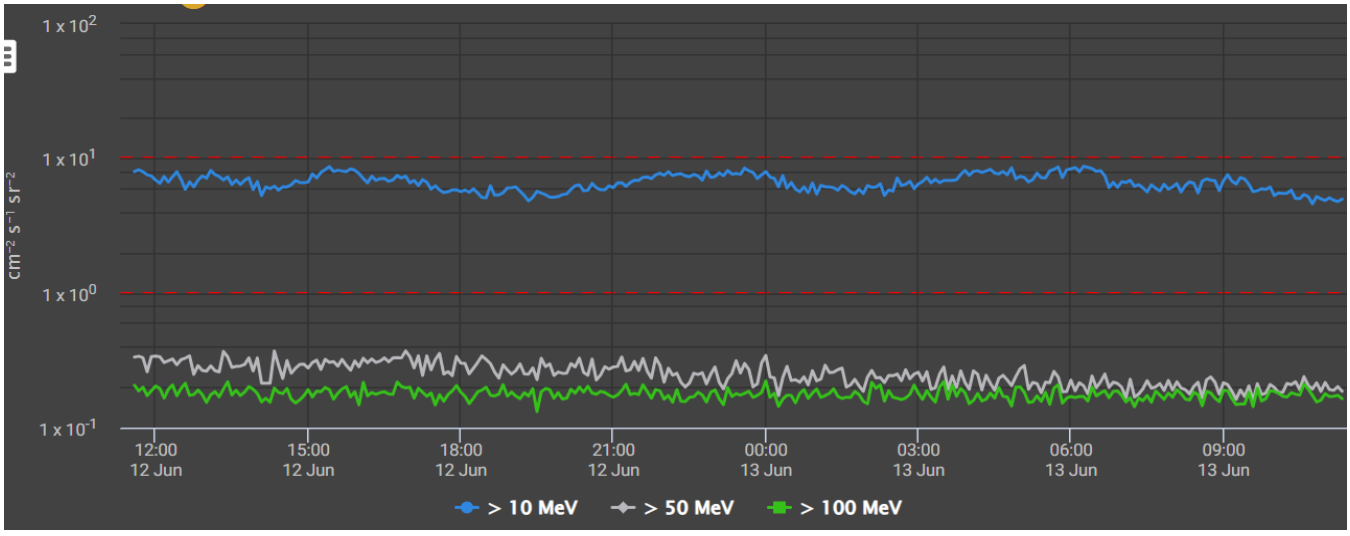
Solar Radiation Storms - (High Energy Protons):

Proton flux levels rose to almost S1/Minor solar radiation storm levels following a far-sided CME, probably from the AR3697 region that has rotated around the western limb in recent days. Proton flux is expected to come back down over the following days but remains close to the S1 threshold. A rise above this threshold is unlikely due to the absence of active spots in a geo-effective position to trigger a proton response. However, there is a slight chance further flaring from far sided AR3697 on Day 1 (13 Jun) or perhaps Day 2 (14 Jun) could result in breaching the S1 threshold for a short time.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	20	10	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 3: Latest GOES-18 Proton Flux



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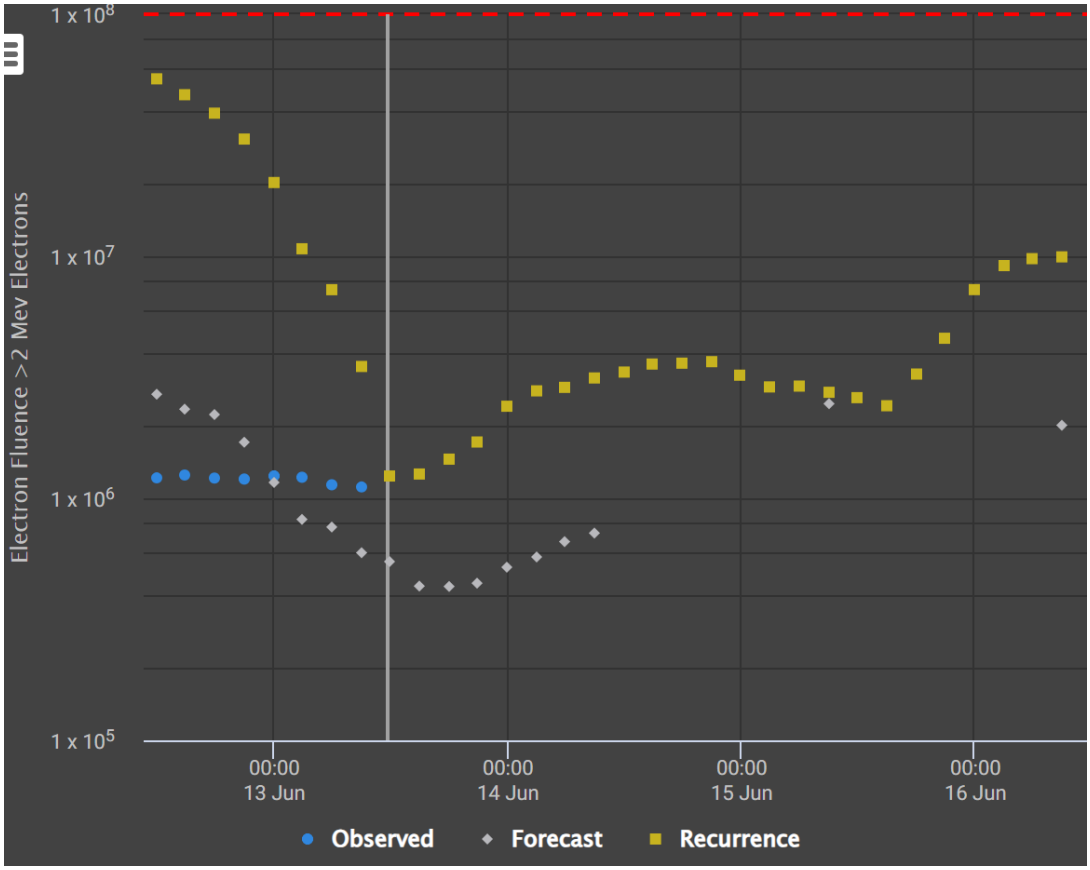
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux is expected to persist at generally background levels for much of this period with no or limited significant sources of enhancement expected. Some diurnal Moderate flux values becoming likely into the period however.

The associated 24 hour fluence is expected to remain well below the Active threshold (1e8 integrated pfu) and the MOSWOC REFM output is considered to provide reasonably good guidance, even if it seems to overestimate the levels.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Latest MOSWOC REFM model



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